HIRSCHMANN
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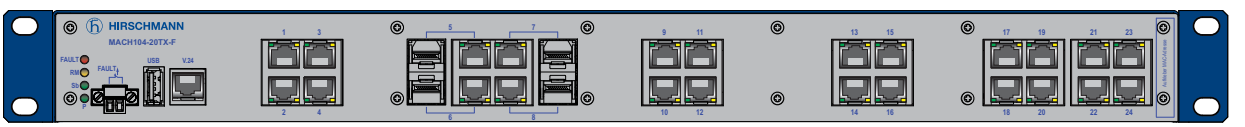
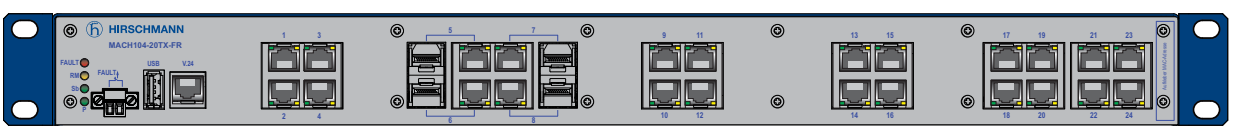
User Manual

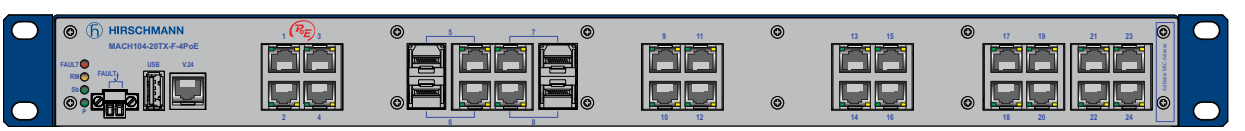
Installation
Industrial ETHERNET Workgroup Switch
MACH104 Family Full Gigabit



MACH104-20TX-F



MACH104-20TX-FR



MACH104-20TX-F-4PoE

039722001021210000

MACH104
Release 02 12/10

Technical Support
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You can get the latest version of this manual on the Internet at the Hirschmann product site (www.beldensolutions.com).

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Safety instructions

This documentation contains instructions which must be observed to ensure your own personal safety and to avoid damage to devices and machinery.

Certified usage

The device may only be employed for the purposes described in the catalog and technical description, and only in conjunction with external devices and components recommended or approved by the manufacturer. The product can only be operated correctly and safely if it is transported, stored, installed and assembled properly and correctly. Furthermore, it must be operated and serviced carefully.

Supply voltage

The supply voltage is electrically isolated from the housing.

- ☐ Use undamaged parts.
- ☐ The device does not contain any service components. Internal fuses are only triggered if there is a fault in the device. If the device is not functioning correctly, or if it is damaged, switch off the voltage supply and return the device to the plant for inspection.
- ☐ Only switch on the device when the housing is closed.
- ☐ Only use connection cables that are permitted for the specified temperature range.
- ☐ Relevant for North America:
  Only use copper wire/conductors of class 1, 60/75°C or 75°C.

Warning!
Only connect a supply voltage that corresponds to the type plate of your device.

Warning: Install an input fuse in the ungrounded voltage cables for every voltage supply connection. For the AC input of the AC/DC power units, use a nominal rating of 3 A, characteristic B.

- ☐ Make sure that the disconnecting device is easily accessible so that the MACH104 device can be disconnected from the mains voltage.
  If you disconnect the device from the mains voltage using
  - the plug in the socket
  - an on/off switch

  it must be easily accessible.

Note: For devices with redundant voltage supply (MACH104-20TX-FR), both non-heating appliance plugs must be pulled to disconnect the device from the mains voltage.

Shielding ground

The shielding ground of the connectable twisted pair lines is connected to the protective conductor connection via the front panel.

☐ Beware of possible short circuits when connecting a cable section with conductive shielding braiding.

Housing

Only technicians authorized by the manufacturer are permitted to open the housing.

The device is grounded via the voltage supply socket.

☐ Make sure that the electrical installation meets local or nationally applicable safety regulations.

☐ The ventilation slots must not be covered so as to ensure free air circulation.

☐ The clearance to the ventilation slots of the housing must be at least 10 cm (3.94 in).

Warning!
Never insert sharp objects (small screwdrivers, wires, etc.) into the inside of the product. There is the risk of an electric shock.

☐ The device must be installed in the horizontal or upright position, either as a table unit in the switch cabinet (see fig. 9) or on the wall (see fig. 10).

☐ If you are operating the device in a 19" switch cabinet: install sliding/ mounting rails for holding the device (see fig. 8).

Environment

The device may only be operated at the specified surrounding air temperature (temperature of the surrounding air at a distance of up to 5 cm (1.97 in) from the device) and relative air humidity specified in the technical data.

☐ Install the device in a location where the climatic threshold values specified in the technical data will be observed.

☐ Use the device only in an environment within the pollution degree specified in the technical data.

Qualification requirements for personnel

Qualified personnel as understood in this manual and the warning signs, are persons who are familiar with the setup, assembly, startup, and operation of this product and are appropriately qualified for their job. This includes, for example, those persons who have been:

▶ trained or directed or authorized to switch on and off, to ground and to label power circuits and devices or systems in accordance with current safety engineering standards;

- trained or directed in the care and use of appropriate safety equipment in accordance with the current standards of safety engineering;
- trained in providing first aid.

General safety instructions

Electricity is used to operate this equipment. Comply with every detail of the safety requirements specified in the operating instructions regarding the voltages to apply (see page 4).

Non-observance of these safety instructions can therefore cause material damage and/or serious injuries.

☐ Only appropriately qualified personnel should work on this device or in its vicinity. These personnel must be thoroughly familiar with all the warnings and maintenance procedures in accordance with this operating manual.

☐ The proper and safe operation of this device depends on proper handling during transport, proper storage and assembly, and conscientious operation and maintenance procedures.

☐ Never start operation with damaged components.

☐ Only use the devices in accordance with this manual. In particular, observe all warnings and safety-related information.

☐ Any work that may be required on the electrical installation may only be carried out by personnel trained for this purpose.

☐ Please note that products recommended as accessories may have characteristics that do not fully correspond to those of the corresponding product. This may limit their possible usage in the overall system.

Note: LED or LASER components in compliance with IEC 60825-1 (2001):
CLASS 1 LASER PRODUCT
CLASS 1 LED PRODUCT

National and international safety regulations

☐ Make sure that the electrical installation meets local or nationally applicable safety regulations.

CE marking

The devices comply with the regulations contained in the following European directive(s):

2004/108/EG
Directive of the European Parliament and the council for standardizing the regulations of member states with regard to electromagnetic compatibility.

2006/95/EG
Directive of the European Parliament and the council for standardizing the regulations of member states with regard to electrical equipment to be used within specific voltage ranges.

In accordance with the above-named EU directive(s), the EU conformity declaration will be at the disposal of the relevant authorities at the following address:

Hirschmann Automation and Control GmbH
Stuttgarter Str. 45-51
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The product can be used in living areas (living area, place of business, small business) and in industrial areas.

- Interference immunity: EN 61000-6-2:2005
- Emitted interference: EN 55022:2006 + A1:2007 Class A

Warning!
This is a class A device. This device can cause interference in living areas, and in this case the operator may be required to take appropriate measures.

Warning!
The assembly guidelines provided in these instructions must be strictly adhered to in order to observe the EMC threshold values.

FCC note:

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference; (2) this device must accept any interference received, including interference that may cause undesired operation.
Appropriate testing has established that this device fulfills the requirements of a class A digital device in line with part 15 of the FCC regulations.
These requirements are designed to provide sufficient protection against interference when the device is being used in a business environment. The device creates and uses high frequencies and can radiate same, and if it is not installed and used in accordance with this operating manual, it can cause radio transmission interference. The use of this device in a living area can also cause interference, and in this case the user is obliged to cover the costs of removing the interference.

Recycling note

After usage, this product must be disposed of properly as electronic waste, in accordance with the current disposal regulations of your county, state and country.

About this manual

The following manuals are included as PDF files on the enclosed CD ROM:

- User manual „Installation“
- User manual “Basic configuration”
- User manual “Redundancy configuration”
- Reference manual “Web-based Interface” and
- Reference manual “Command Line Interface”

The Network Management Software HiVision/Industrial HiVision provides you with additional options for smooth configuration and monitoring:

- Configuration of multiple devices simultaneously.
- Graphical interface with network layouts.
- Auto-topology discovery.
- Event log.
- Event handling.
- Client / Server structure.
- Browser interface
- ActiveX control for SCADA integration
- SNMP/OPC gateway

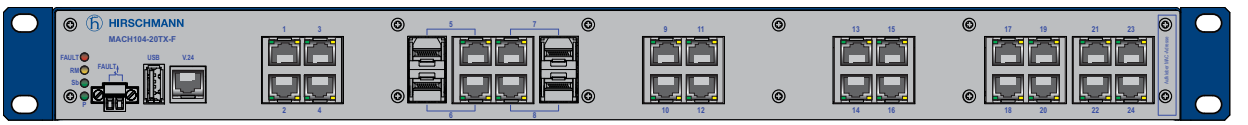
Legend

The symbols used in this manual have the following meanings:

▶	Listing
☐	Work step
■	Subheading

1 Device description

The MACH104 devices are managed Workgroup switches with 24 Gigabit Ethernet ports. They allow you to construct switched industrial ETHERNET networks that conform to the IEEE 802.3 and 802.3u standards using copper wires or optical fibers in a bus or ring topology. You can connect terminal devices and other infrastructure components via twisted pair cables, multi-mode F/O and single-mode F/O. The twisted pair ports support autocrossing, autonegotiation and autopolarity.



The MACH104 devices provide you with a range of switch variants. You set up your own switch according to your requirements regarding the transmission media type, redundant voltage supply and software variant.

The devices are designed for the special requirements of industrial automation. They meet the relevant industry standards, provide very high operational reliability, even under extreme conditions, and also long-term reliability and flexibility. The devices work without a fan. If desired, the voltage supply can be redundant - depending on the device variant. The basic devices are suitable for mounting on the 19" rack and for wall mounting.

The HIPER-Ring redundancy concept enables you to quickly carry out a reconfiguration, and also a simple configuration with only one additional connection. The diagnosis display and the display of the operating parameters and the large label areas provide a quick overview.
It can be easily managed via a Web browser, via Telnet, with a management software product (such as HiVision) or locally on the switch (V.24 interface).

The devices provide you with a large range of features:

- Redundancy functions
  (Rapid Spanning Tree, Redundant Ring Structure, HIPER-Ring, Redundant Coupling, Link Aggregation)
- Protection from unauthorized access
- Synchronized system time in the network
- Network load control
- Operation diagnosis
- Diagnostics (hardware self-testing)
- Reset
- Priority
- VLAN
- Topology Discovery

- Web-based Interface
- Command Line Interface
- SNMP
- 802.1x port authentication
- Real Time Clock

The addition, to the MACH 100 family, of the MICE and RS20/RS30/RS40 open rail family switches, the MACH 3000 and MACH 4000 family of backbone switches, the BAT wireless transmission system, the EAGLE security system, and products for the RSR20/RSR30 and MACH 1000 substation areas, provides continuous communication across all levels of the company.

1.1 Description of the device variants

A basic device contains all the functions of the industry Switch and 24 Gigabit Ethernet interfaces for connection to the LAN. The devices can be managed.

- The 4 Gigabit ETHERNET combo ports (can be connected optically or with TX) of the basic devices are suitable for the connection of terminal devices or network segments according to the standards IEEE 802.3 100/1000BASE-FX (SFP slot) and IEEE 802.3 1000BASE-T / 100BASE-TX / 10BASE-T (RJ45 socket). A plugged SFP module switches the TX port off.
- The 20 Gigabit ETHERNET ports (10/100/1000 Mbit/s) are suitable for connecting terminal devices or network segments according to the standards IEEE 802.3 1000BASE-T / 100BASE-TX / IEEE 802.3 10 BASE-T. These ports support autonegotiation and autopolarity. The ports are RJ45 sockets. The housings of the RJ45 sockets are electrically connected to the front plate of the device. The pin assignment is identical to MDI-X. When the autonegotiation function is enabled, these ports also support autocrossing.
  In the MACH104-20TX-F-4PoE devices, ports 1 to 4 also support Power over Ethernet (PoE).
- Voltage range: 100 - 240 V AC
- Temperature range: 0°C to +50 °C
- Software variant: Professional

The devices comply with the specifications of the ISO/IEC standards
8802-3u 100BASE-TX/-1000BASE-T,
8802-3 100BASE-FX and
8802-3 1000BASE-SX/LX.

The MACH104 device contains all the function units, such as: Switch function, Management function, Redundancy function, voltage connection, management connection.

- Specific functions of TP/TX interface
  - Link Control
  - Auto Polarity Exchange
  - Autonegotiation
  - Autocrossing (device may be connected with a crossed-over or an un-crossed cable)
- Specific functions of fiber optic interface
  - Link Down monitoring

The MACH104-20TX-F, MACH104-20TX-FR and MACH104-20TX-F-4PoE devices from the Industrial ETHERNET family MACH104 are Switches with fixed configurations.

MACH104 Family	Description
MACH104-20TX-F	MACH104 family basic device with 4 x Gigabit ETHERNET combo port, 20 x Gigabit ETHERNET TX
MACH104-20TX-FR	MACH104 family basic device with 4 x Gigabit ETHERNET combo port, 20 x Gigabit ETHERNET TX and redundant power supply
MACH104-20TX-F-4PoE	MACH104 family basic device with 4 x Gigabit ETHERNET combo port, 20 x Gigabit ETHERNET TX, of which 4 ports have Power over Ethernet (PoE, ports 1 to 4)

1.1.1 MACH104 devices with 24 GB ports

- MACH104-20TX-F
  - 4 Gigabit ETHERNET combo ports
  - 20 Gigabit ETHERNET ports

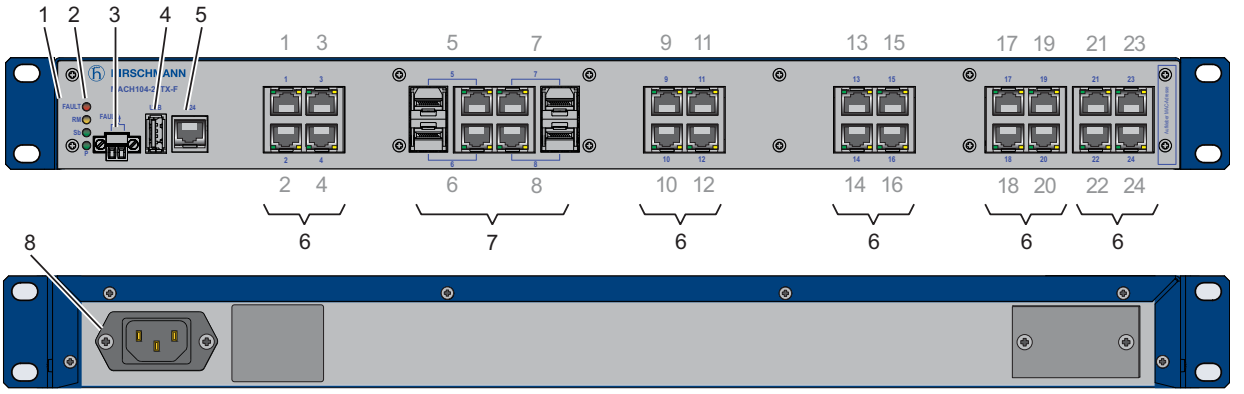


Figure 1: Overview of interfaces and display and control elements in the MACH104-20TX-F
1 - MACH104-20TX-F device
2 - LED display elements
3 - Signal contact
4 - USB interface
5 - V.24 connection for external management
6 - See following table, column 1
7 - See following table, column 2
8 - Connection for voltage supply (side of device)

Gigabit ETHERNET 4 x GE ports	Gigabit ETHERNET 4 x GE ports (combo ports)
4 * twisted pair TX, RJ45, 10/100/1000 Mbit/s	100/1000 Mbit/s F/O, SFP slots Alternative connections: 10/100/1000 Mbit/s twisted pair, RJ45 connections

1.1.2 MACH104 devices with 24 GB ports and redundant voltage supply

- MACH104-20TX-FR
  - 4 Gigabit ETHERNET combo ports
  - 20 Gigabit ETHERNET ports
  - The power supply is connected redundantly.

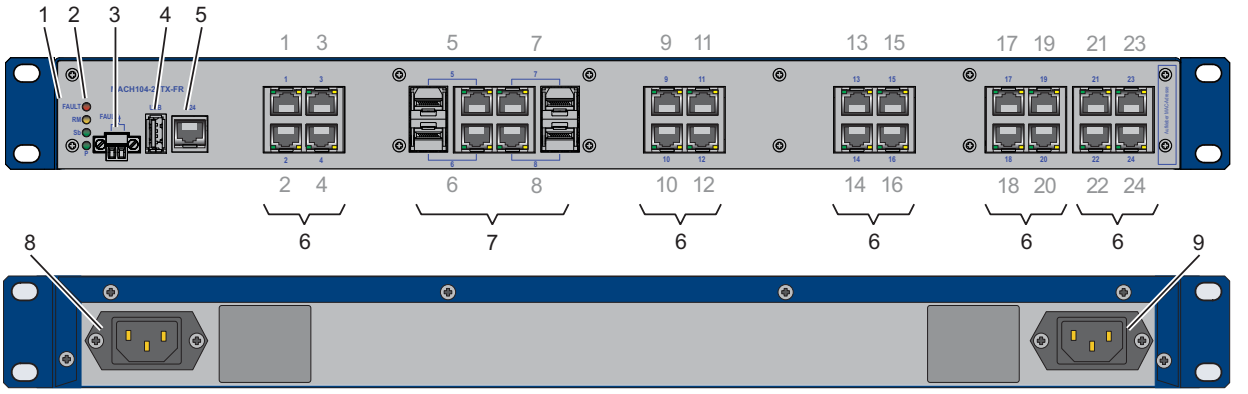


Figure 2: Overview of interfaces and display and control elements in the MACH104-20TX-FR
1 - MACH104-20TX-FR device
2 - LED display elements
3 - Signal contact
4 - USB interface
5 - V.24 connection for external management
6 - See following table, column 1
7 - See following table, column 2
8 - P1: Connection for voltage supply (back of device)
9 - P2: Connection for redundant voltage supply (back of device)

Gigabit ETHERNET 4 x GE ports	Gigabit ETHERNET 4 x GE ports (combo ports)
4 * twisted pair TX, RJ45, 10/100/1000 Mbit/s	100/1000 Mbit/s F/O, SFP slots Alternative connections: 10/100/1000 Mbit/s twisted pair, RJ45 connections

1.1.3 MACH104 devices with 24 GB ports, 4 of which are PoE ports

- MACH104-20TX-F-4PoE
  - 4 Gigabit ETHERNET combo ports
  - 20 Gigabit ETHERNET ports, of which 4 are PoE-capable (Power over Ethernet)
  - Integrated PoE voltage supply for 4 PoE ports

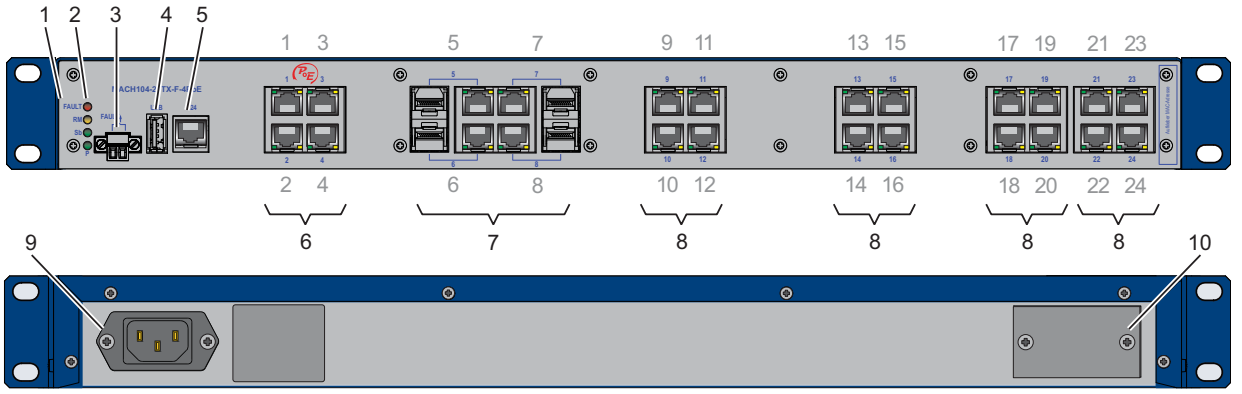


Figure 3: Overview of interfaces and display and control elements in the MACH104-20TX-F-4PoE
1 - MACH104-20TX-F-4PoE device
2 - LED display elements
3 - Signal contact
4 - USB interface
5 - V.24 connection for external management
6 - See following table, column 1
7 - See following table, column 2
8 - See following table, column 3
9 - Connection for voltage supply (side of device)
10 - Integrated PoE power unit (back of device)

Gigabit ETHERNET 4 x GE ports with PoE	Gigabit ETHERNET 4 x GE ports (combo ports)	Gigabit ETHERNET 4 x GE ports
4 * twisted pair TX, RJ45, 10/100/1000 Mbit/s, Power over Ethernet	100/1000 Mbit/s F/O, SFP slots Alternative connections: 10/100/1000 Mbit/s twisted pair, RJ45 connections	4 * twisted pair TX, RJ45, 10/100/1000 Mbit/s

1.1.4 PoE ports

The MACH104-20TX-F-4PoE device variants support Power over Ethernet (PoE) in accordance with IEEE 802.3af.

They allow the connection and remote supply of, for example, IP telephones (Voice over IP), webcams, sensors, printer servers and WLAN access points via 10BASE-T/100BASE-TX/1000BASE-T. With PoE, these terminal devices are powered by the twisted-pair cable.

The MACH104-20TX-F-4PoE provides four 10BASE-T/100BASE-TX/ 1000BASE-T ports (RJ45 sockets) for connecting network segments or PoE terminal devices (PD, Powered Device) for all IEEE802.3af classes up to a maximum power output of 15.4 W.

The 4 PoE-capable ports are the 4 first ports on the device (ports 1 to 4, see figure in chapter „MACH104 devices with 24 GB ports, 4 of which are PoE ports“ on page 14. The PoE ports are indicated with the red PoE logo on the device.

The current is supplied on wire pairs transmitting the signal; the individual ports are not electrically insulated from each other.
The following conditions are met in accordance with IEEE 802.3af:

- Endpoint PSE
- Alternative A

1.1.5 Combo ports

At the four Gigabit ETHERNET combo ports (see fig. 4 and fig. 5) you can connected either F/O (via SFP modules) or twisted pair.

SFP modules

SFP modules are optical transceivers (Fast ETHERNET and Gigabit ETHERNET SFP modules, see page 35). SFP stands for Small Form-factor Pluggable and is also frequently referred to as mini-GBIC (GigaBit Interface Converter).
The SFP modules are plugged into the SFP slots of the MACH104 device in order to obtain an F/O port. The MACH104 has four TP interfaces and four slots for inserting SFP modules (100/1000 Mbit/s).
By inserting the SFP module you deactivate the corresponding TP interface.

Note: Only use Hirschmann SFP modules (see page 35 „Accessories“).

2 Assembly and start-up

The devices have been developed for practical application in a harsh industrial environment. The installation process is correspondingly simple.

On delivery, the device is ready for operation.
The following procedure has been proven to be successful for the assembly of the device:

- Unpacking and checking
- Installing the SFP modules (optional)
- Signal contact
- Installing the device and grounding
- Supply voltage
- Startup
- Connecting the data lines

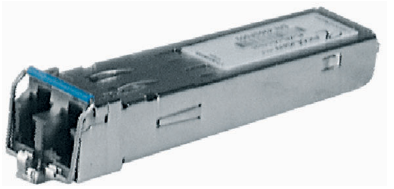
2.1 Installing the device

Note: Note the safety instructions in the chapter from page 4 and only connect a supply voltage that corresponds to the type plate of your device.

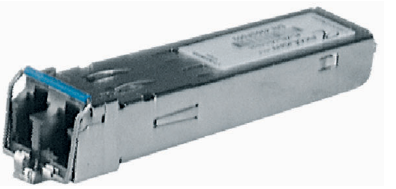
2.1.1 Unpacking and checking

☐ Check that the contents of the package are complete (see page 35 „Scope of delivery“).
☐ Check the individual parts for transport damage.

2.1.2 Installing the SFP modules (optional)



Fast ETHERNET
fiberoptic SFP module



Gigabit ETHERNET
fiberoptic SFP module

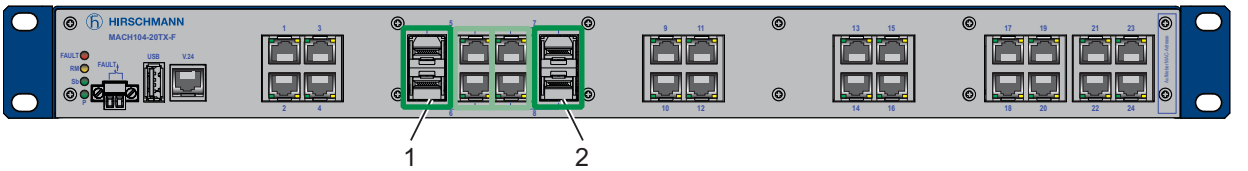


Figure 4: MACH104 device, front view
1 - Ports 5 + 6: Two SFP slots that are used as alternatives to the RJ45 ports
2 - Ports 7 + 8: Two SFP slots that are used as alternatives to the RJ45 ports

☐ Push the SFP module with the lock closed into the socket until it latches audibly in place.

Note: Only use Hirschmann SFP modules (see page 35 „Accessories“).

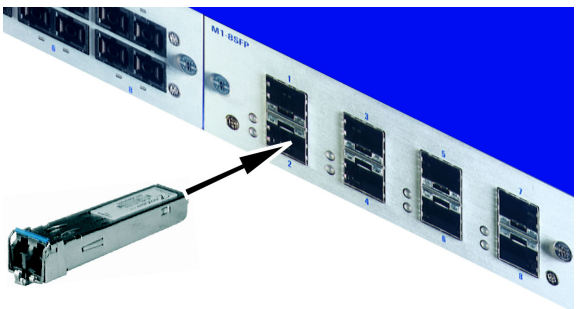


Figure 5: Installing an SFP module

2.1.3 “FAULT” signal contact

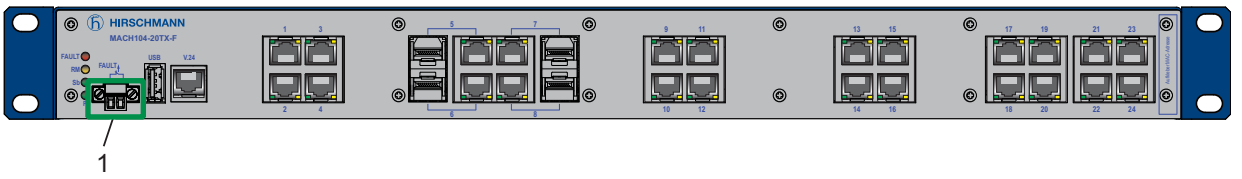


Figure 6: MACH104 device, front view
1 - Signal contact

The signal contacts are connected via a 2-pin terminal block with screw locking.

- The signal contact (“FAULT”, for pin assignment of terminal block, see fig. 7) monitors the functioning of the device, thus enabling remote diagnostics. You can specify the type of function monitoring in the Management.
- You can also use the Management to switch the signal contact manually and thus control external devices.

A break in contact is used to report the following conditions via the potential-free signal contact (relay contact, closed circuit):

- The failure of at least one of the two voltage supplies (voltage supply 1 or 2 is below the threshold value).
- A continuous malfunction in the device (internal supply voltage).
- The defective link status of at least one port. The report of the link status can be masked by the Management for each port. In the default state, link status monitoring is deactivated.
- The temperature threshold value has been exceeded or has fallen below.
- The removal of the ACA.

The following condition is also reported in RM mode:

- Ring redundancy guaranteed. By default, there is no ring redundancy monitoring

Connecting the terminal block

☐ Pull the terminal block off the device and connect the signal lines.

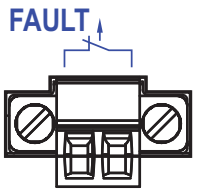


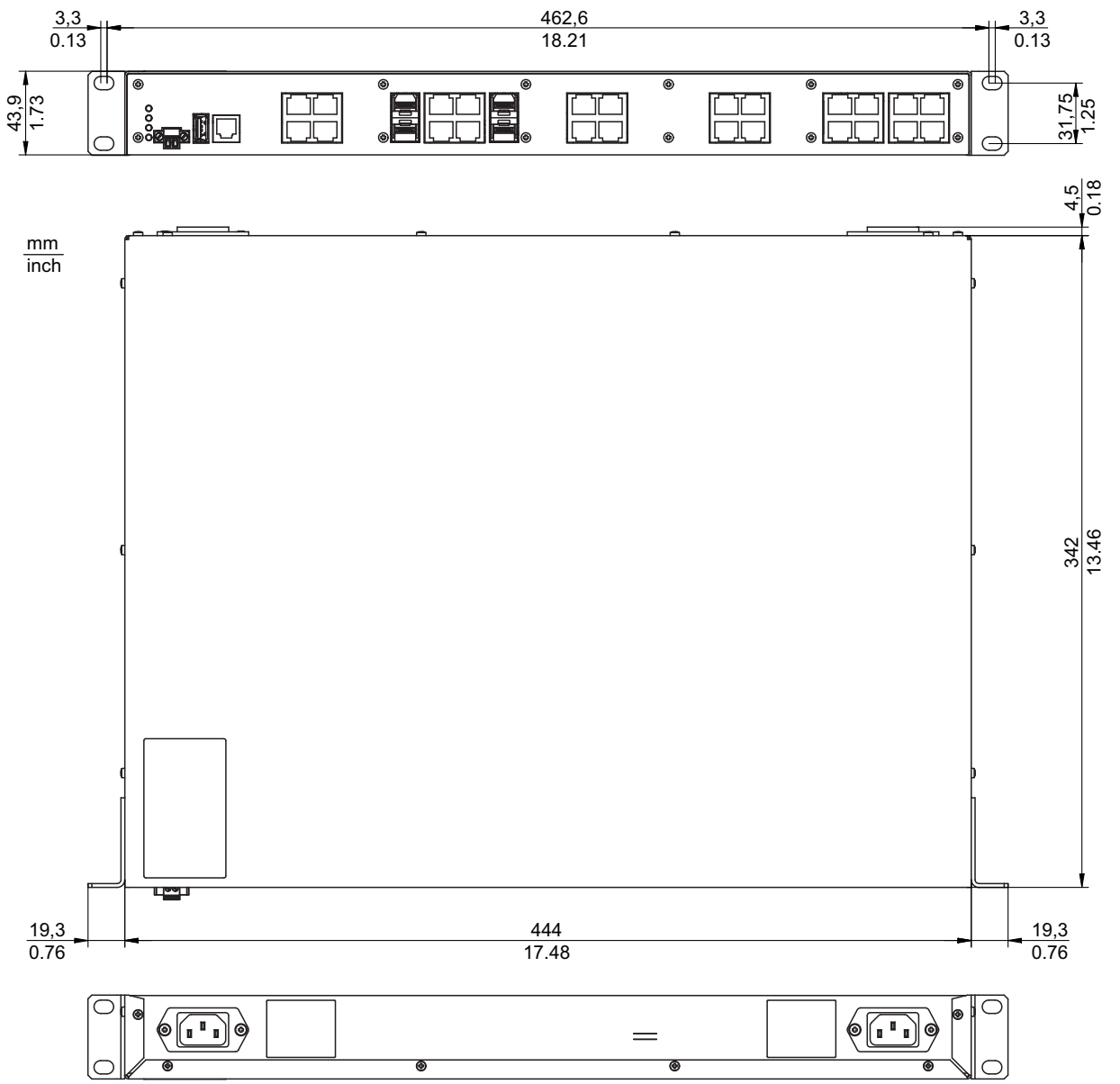
Figure 7: 2-pin terminal block

Note: Please note the electrical ratings for the signal contact (see on page 32 „General technical data“).

Note: Relevant for North America:
The tightening torque of the terminal block screws is 3 lb in. (0.34 Nm).

☐ Mount the terminal block for the signal contact on the front of the device using the screw locking. Check whether the terminal block is mounted correctly and screwed on.

2.1.4 Dimension drawings



2.1.5 Installing the device and grounding

The device can be mounted on a flat surface, in a 19" standard switch cabinet, or on the wall.

Consider the following criteria when selecting the location for mounting your device:

- ☐ The installation location should be close to a power outlet.
- ☐ The climatic threshold values listed in the technical data must be adhered to.
- ☐ The ventilation slots must not be covered so as to ensure free air circulation.
- ☐ The clearance to the ventilation slots of the housing must be at least 10 cm (3.94 in).
- ☐ The installation location should be freely accessible for the installation and for maintenance and repairs.
- ☐ The LED display elements should be clearly and easily visible.
- ☐ Make sure that the TP cable is far enough away from power cables and other sources of possible electrical interference.
- ☐ Make sure that the device is connected to a separate power source with a ground connection and a main voltage in line with the technical data, and that the device is supplied with power via a separate isolator or power switch. It is recommended to use overvoltage protection for all devices.

Note: The shielding ground of the connectable industrial twisted pair lines is connected to the front panel as a conductor.

Mounting the MACH104 as a table unit

- ☐ Install the device in line with the criteria listed in „Installing the device and grounding“.

Mounting the MACH104 in a switch cabinet

The devices are designed to be mounted in a 19" rack.

- ☐ Make sure there is sufficient ventilation. If necessary, provide a fan for the 19" rack. This will prevent the basic devices from overheating.
- ☐ Measure the depth of the 19" rack so as to allow the main cable, and any power supply cables, to be fitted from the back, and the data cables to be fitted from the front.

If you are operating the device in a 19" switch cabinet, you must install sliding/mounting rails (not included in the delivery) to hold the weight of the device.

Warning!
If the device is installed in a 19" switch cabinet without sliding/mounting rails, increased vibration can cause damage to the device and/or its modules.

For more information on sliding/mounting rails and how to install them, please contact your switch cabinet manufacturer.

☐ Install the sliding/mounting rails in the 19" switch cabinet as instructed by the manufacturer, and make sure the device is resting on both rails.

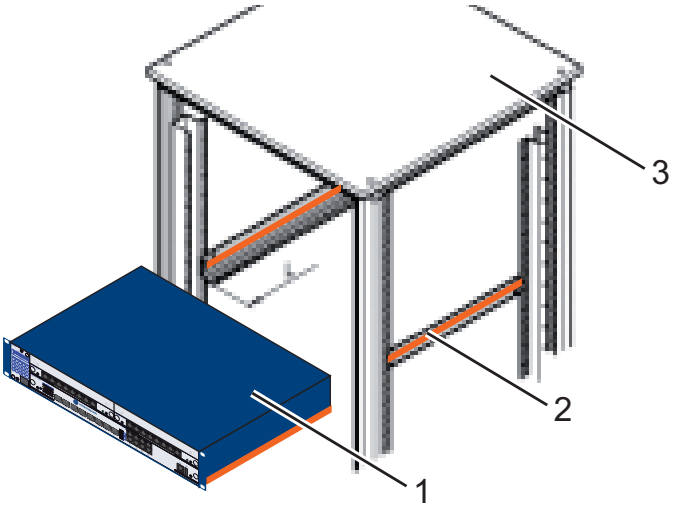


Figure 8: Installation in the switch cabinet with sliding/mounting rails
1 - MACH104 device
2 - Sliding/mounting rail
3 - 19" cabinet

On delivery, two brackets are attached to the sides of the device (see figure below).

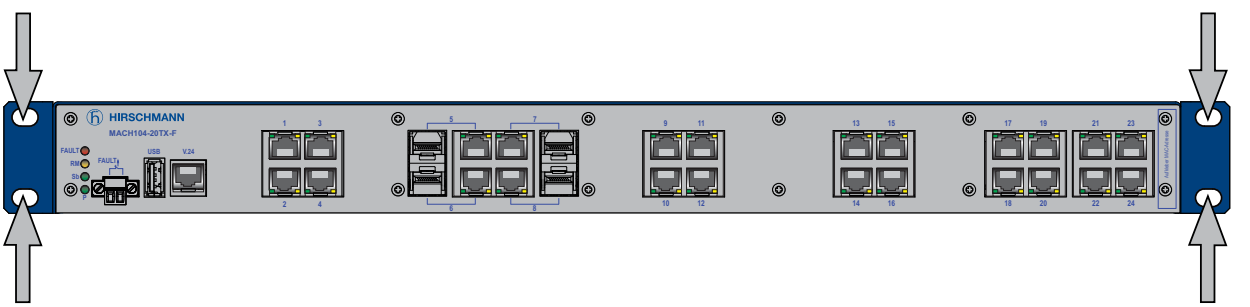


Figure 9: Mounting the MACH104 in the 19" cabinet

☐ Fasten the device by screwing the brackets to the switch cabinet.

Warning!
When installing the device, make sure the ventilation slots remain unobstructed, as otherwise the device can overheat and be damaged.

Note: When operating the device in environments with strong vibrations, the device can be fastened with two additional brackets at the back of the switch cabinet (see on page 35 „Accessories“), not included in the delivery.

Installing the MACH104 on the wall

- ☐ Use the pre-mounted brackets included in the delivery as shown in the following figure (see fig. 10).
- ☐ Attach two additional brackets to the device (see on page 35 „Accessories“, not included in the delivery) as shown in the following figure (see fig. 10).
- ☐ Fasten the device by screwing the brackets to the wall.

Warning!
When installing the device, make sure the ventilation slots remain unobstructed, as otherwise the device can overheat and be damaged.

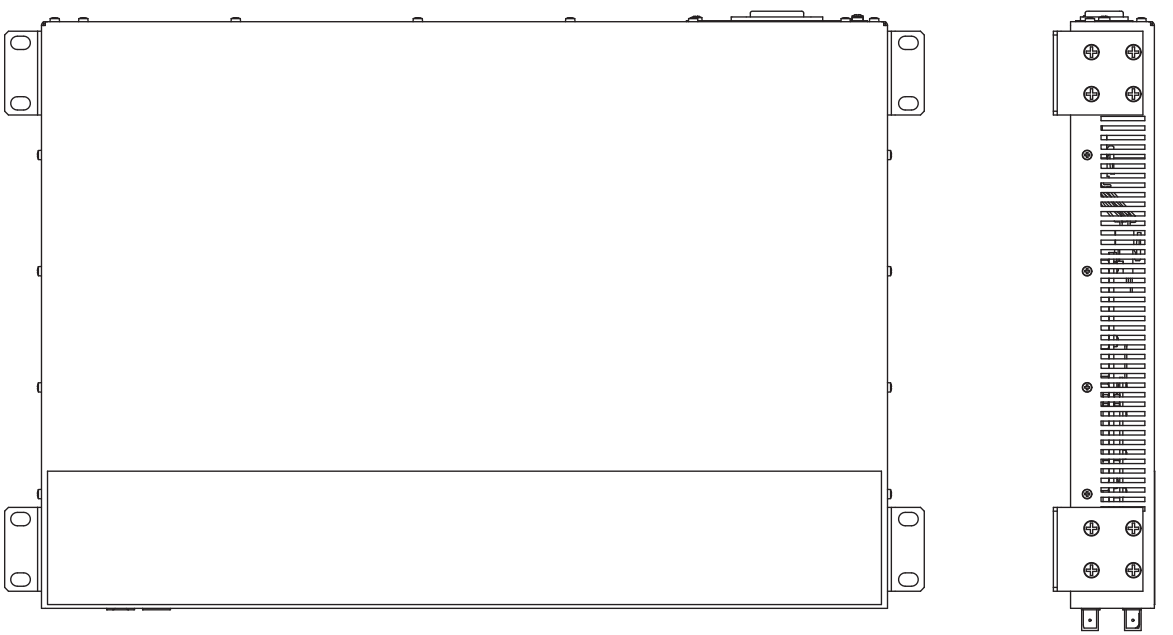


Figure 10: Vertical mounting on the wall

Note: The shielding ground of the connectable industrial twisted pair lines is connected to the front panel as a conductor.

Grounding

The device is grounded via the voltage supply socket ((see fig. 1) and (see fig. 2)).

2.1.6 Supply voltage

The input voltage range of the MACH104 basic devices is designed as 100 - 240 VAC.
The power supply of the MACH104-20TX-FR devices is redundant.

Note: Note the safety instructions in the chapter from page 4 „Safety instructions“ and only connect a supply voltage that corresponds to the type plate of your device.

MACH104-20TX-F

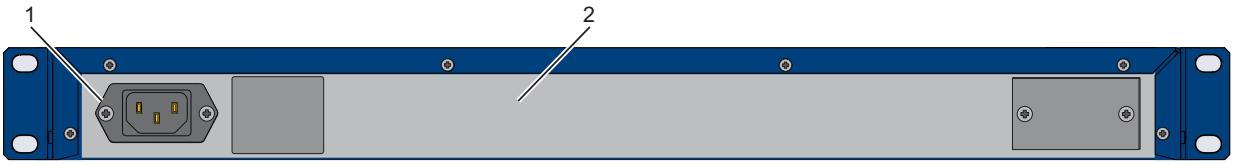


Figure 11: Connections of the MACH104-20TX-F on the back of the device
1 - Voltage supply 100 - 240 V AC
2 - MACH104-20TX-F device

MACH104-20TX-FR

The supply voltage can be connected redundantly. Both inputs are uncoupled. There is no distributed load. With redundant supply, the standard voltage supply alone supplies the device. The redundant voltage supply automatially becomes active if the standard voltage supply fails. In the normal case, the redundant voltage supply works in stand-by mode. The supply voltage is electrically isolated from the housing.

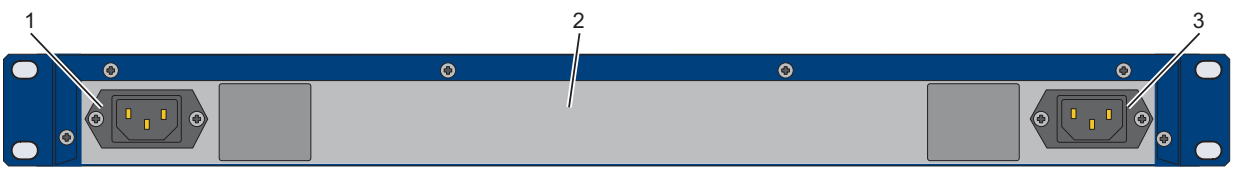


Figure 12: Connections of the MACH104-20TX-FR on the back of the device
1 - Standard voltage supply 100 - 240 V AC
2 - MACH104-20TX-FR device
3 - Redundant voltage supply 100 - 240 V AC

Note: With non-redundant supply of the main voltage, the device reports a loss of power. You can avert this message by applying the supply voltage via both inputs, or by changing the configuration in the Management.

MACH104-20TX-F-4PoE

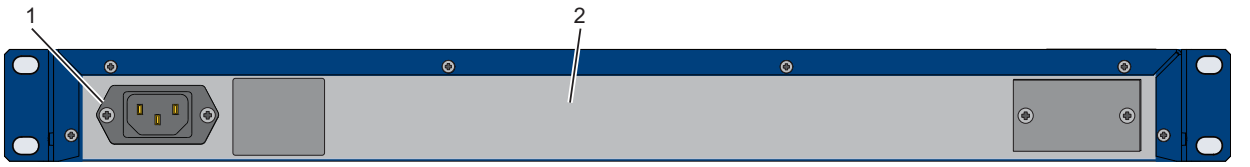


Figure 13: Connections of the MACH104-20TX-F-4PoE on the back of the device
1 - Standard voltage supply 100 - 240 V AC
2 - MACH104-20TX-F-4PoE device

2.1.7 Startup procedure

By connecting the voltage supply via the voltage supply socket(s), you start the operation of the device.

2.1.8 Connecting the data lines

10/100/1000 Mbit/s twisted pair connection

These connections are RJ45 sockets.

10/100/1000 Mbit/s TP ports enable the connection of terminal devices or independent network segments according to the IEEE 802.3 10BASE-T/ 100BASE-TX/1000BASE-T standard.

The MACH104-20TX-F-4PoE devices also allow
IEEE 802.3af (Power over ETHERNET on data lines).

These ports support:

- Autonegotiation
- Autopolarity
- Autocrossing (if autonegotiation is activated)
- 1000 Mbit/s full duplex
- 100 Mbit/s half-duplex mode, 100 Mbit/s full duplex mode
- 10 Mbit/s half-duplex mode, 10 Mbit/s full duplex mode

- The MACH104-20TX-F-4PoE devices also allow
  Power over ETHERNET (PoE, at the first four ports of the device)
  The PoE voltage is input via the wire pairs transmitting the signal (phantom voltage).

State on delivery: autonegotiation activated.
The socket housing is electrically connected to the front panel.
The pin assignment corresponds to MDI-X.

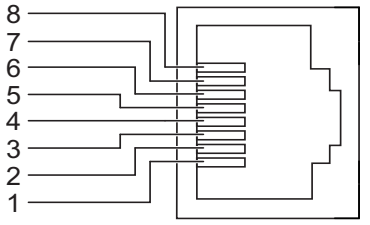
Figure	Pin	Function	In the MACH104-20TX-F-4PoE: Power over Ethernet (PoE)
	1	BI_DB +	V -
	2	BI_DB -	V -
	3	BI_DA +	V +
	4	BI_DD +	
	5	BI_DD -	
	6	BI_DA -	V +
	7	BI_DC +	
	8	BI_DC -	

Table 1: Pin assignment of a 1000 MBit/s TP interface in MDI-X mode, RJ45 socket - for PoE with the power supplied via the wire pairs transmitting the signal

100 Mbit/s F/O connection

These ports are SFP slots.
100 MBit/s F/O ports enable the connection of terminal devices or independent network segments in compliance with the IEEE 802.3 100BASE-FX standard.
These ports support:

- Full or half duplex mode

State on delivery: full duplex FDX

Note: Make sure that the LH ports are only connected with LH ports, SM ports are only connected with SM ports, and MM ports only with MM ports.

1 Gbit/s F/O connection

These ports are SFP slots.
1 Gbit/s F/O ports enable the connection of terminal devices or independent network segments according to the IEEE 802.3 1000BASE-SX/1000BASE-LX standard.
These ports support:

- Autonegotiation
- Full duplex mode

State on delivery: autonegotiation activated.

Note: Make sure that the LH ports are only connected with LH ports, SX ports are only connected with SX ports, and LX ports only with LX ports.

2.2 Display elements

After the operating voltage is set up, the software starts and initializes itself. Afterwards, the device performs a self-test. During this process, various LEDs light up.

The process takes around 15 seconds.

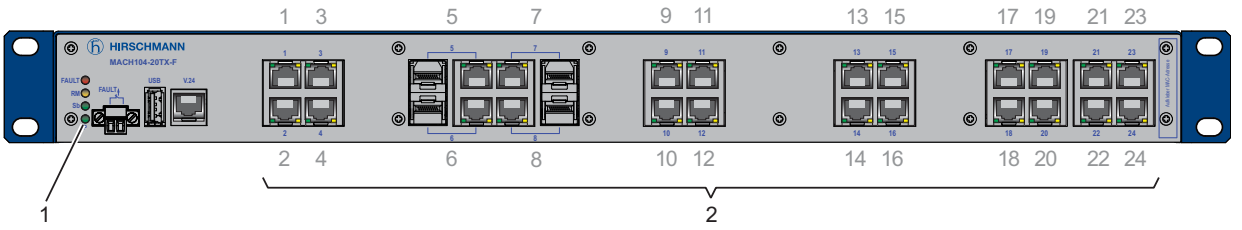


Figure 14: MACH104 Display elements
1 - Device status display elements
2 - Port status display elements

Device state

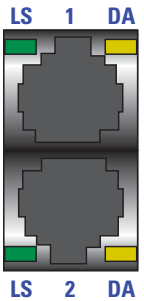
These LEDs provide information about conditions which affect the operation of the whole device.

P - Power (green/yellow LED)	
Glowing green	MACH104-20TX-F, MACH104-20TX-F-4PoE: Supply voltage is on. MACH104-20TX-FR: Supply voltages 1 and 2 are on.
Glowing yellow	MACH104-20TX-FR: Supply voltage 1 or 2 is on.
Not glowing	MACH104-20TX-F, MACH104-20TX-F-4PoE: Supply voltage is below minimum value. MACH104-20TX-FR: Supply voltages 1 and 2 are below minimum value.
RM - Ring Manager (green/yellow LED)	
Glowing green	RM function active, redundant port disabled
Glowing yellow	RM function active, redundant port enabled
Not glowing	RM function not active
Flashing green	Incorrect configuration of the HIPER-Ring (e.g. the ring is not connected to the ring port).
Sb StandBy - stand-by mode (green LED)	
Glowing green	Stand-by mode enabled.
Not glowing	No stand-by mode.
FAULT - signal contact (red LED)	
Glowing red	Signal contact 1 is open, i.e. it is reporting an error.
Not glowing	Signal contact 1 is closed, i.e. it is not reporting an error.

RM and Stand-by - display saving processes of the AutoConfiguration Adapter (ACA)	
Flashing alternately	Error during saving process.
LEDs flash synchronously, two times a second	Loading configuration from the ACA.
LEDs flash synchronously, once a second	Saving the configuration in the ACA.

If the manual adjustment is active on the “FAULT” signal contact, then the detected error display is independent of the setting of the signal contact.

Port state



These LEDs display port-related information.

LS - link status (one green LED per port)	
Not glowing	No valid connection.
Glowing green	Valid connection.
Flashing green (1 time a period)	Port is switched to stand-by.
Flashing green (3 times a period)	Port is switched off.

DA - data (one yellow LED per port)	
Flashing yellow	Receive data / send data.

2.3 Basic set-up

The IP parameters must be entered when the device is installed for the first time. The device provides 6 options for configuring IP addresses:

- Entry via V.24 connection
- Entry using the HiDiscovery protocol
- Configuration via BOOTP
- Configuration via DHCP
- Configuration via DHCP Option 82
- Auto Configuration Adapter

Further information on the basic settings of the device can be found in the "Basic Configuration" user manual on the CD ROM.

Default settings

- IP address: The device looks for the IP address using DHCP
- Management password:
  user, password: public (read only)
  admin, password: private (read and write)
- V.24 data rate: 9,600 Baud
- Ring redundancy: off
- Ethernet ports: link status is not evaluated (signal contact)
- Optical 100 Mbit/s ports: 100 Mbit/s full duplex
  All other ports: autonegotiation
- Redundancy manager switched off
  (DIP switch RM and Stand-by: ON)
- Stand-by coupling switched off
  (DIP switch RM and Stand-by: ON)
  Port 3 = control port, port 4 = coupling port for redundant ring coupling
- Rapid Spanning Tree: on

USB interface

The USB socket has an interface for the local connection of an AutoConfiguration Adapter (part number ACA 21-USB see on page 35 „Accessories“). It is used for saving/loading the configuration and for loading the software.

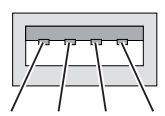
Figure	Pin	Function
 1 2 3 4	1	VCC (VBus)
	2	- Data
	3	+ Data
	4	Ground (GND)

Table 2: Pin assignment of the USB interface

V.24 interface (external management)

A serial interface is provided on the RJ11 socket (V.24 interface) for the local connection of an external management station (VT100 terminal or PC with appropriate terminal emulation) or an AutoConfiguration Adapter ACA 11. This enables a connection to the Command Line Interface (CLI) and the system monitor to be made.

VT 100 terminal settings	
Speed	9,600 Baud
Data	8 bit
Stopbit	1 bit
Handshake	off
Parity	none

The socket housing is electrically connected to the front panel of the device. The V24 interface is not electrically isolated from the supply voltage.

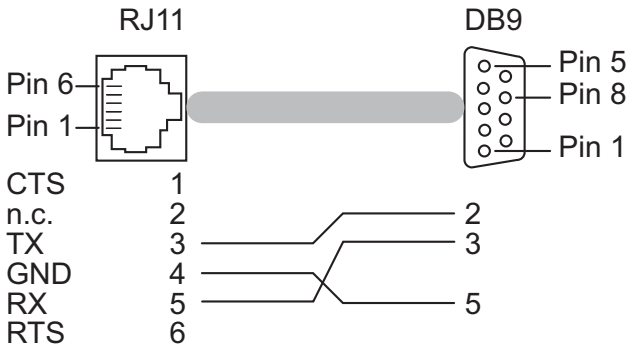


Figure 15: Pin assignment of the V24 interface

Note: You will find the order number for the terminal cable, which is ordered separately, in the Technical Data chapter (see on page 32 „Technical data“).

2.4 Disassembly

Disassembling the device

☐ To detach the device from the switch cabinet or the wall, remove the screws from the brackets on the device.

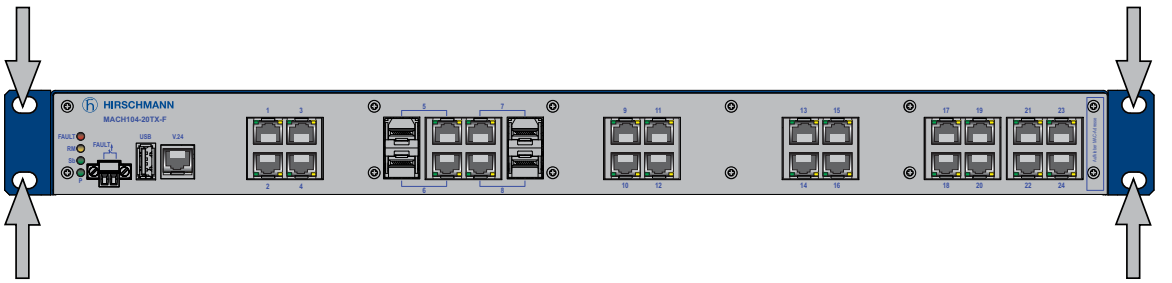


Figure 16: Disassembling the device

Disassembling the SFP modules

☐ Pull the SFP module out of the socket by means of the opened lock.

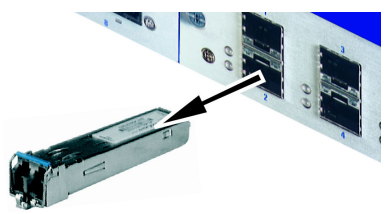


Figure 17: Deinstalling an SFP module

3 Technical data

General technical data

Dimensions W × H × D	MACH104-...	448 mm x 44 mm x 345 mm (without brackets)
Weight	MACH104-20TX-F MACH104-20TX-FR MACH104-20TX-F-4PoE	4.2 kg 4.4 kg 4.6 kg
Operating voltage	Rated voltage Voltage range	100 V AC - 240 V AC, 50 Hz - 60 Hz 90 V AC - 265 V AC, 47 Hz - 63 Hz
Current consumption	Rated power	max. 0.3 A (240 V AC) max. 0.5 A (100 V AC) max. 0.9 A (240 V AC) for devices with PoE max. 1.7 A (100 V AC) for devices with PoE
Overload current protection at input		Non-replaceable fuse
Activation current		typ. <40 A at 265 V AC and cold start
"FAULT" signal contact	Switching current	max. 1 A, SELV
	Switching voltage	max. 60 V DC or max. 30 V AC, SELV
Environment	Storage temperature (ambient air temperature) Humidity Air pressure (in operation)	-20 °C to +85 °C 10% to 95% (non-condensing) Up to 2000 m (795 hPa), higher altitudes on request
Operating temperature (surrounding air)		0 °C to +50 °C
Pollution degree		2
Protection classes	Laser protection Protection class	Class 1 according to EN 60825-1 (2001) IP 30

EMC and immunity

EMC interference immunity		
EN 61000-4-2	Electrostatic discharge Contact discharge Air discharge	 4 kV 8 kV
EN 61000-4-3	Electromagnetic field 80 - 2,700 MHz	 10 V/m
EN 61000-4-4	Fast transients (burst) - Power line - Data line	 2 kV 4 kV
EN 61000-4-5	Voltage surges - Power line, line/line: - Power line, line/earth - Data line	 1 kV 2 kV 4 kV
EN 61000-4-6	Line-conducted interference voltages 150 kHz - 80 MHz	 10 V

EMC emitted interference		
EN 55022	Class A	Yes
FCC 47 CFR Part 15	Class A	Yes

Network range

TP port	
Length of a twisted pair segment	max. 100 m / 328 ft (cat5e cable with 1000BASE-T)

Table 3: TP port 10BASE-T / 100BASE-TX / 1000BASE-T

Product code M-FAST-SFP-...		Wave length	Fiber	System attenuation	Expansion	Fiber data
-MM/LC...	MM	1310 nm	50/125 µm	0-8 dB	0-5 km	1.0 dB/km, 800 MHz*km
-MM/LC...	MM	1310 nm	62.5/125 µm	0-11 dB	0-4 km	1.0 dB/km, 500 MHz*km
-SM/LC...	SM	1310 nm	9/125 µm	0-13 dB	0-25 km	0.4 dB/km; 3.5 ps/(nm*km)
-SM+/ LC...	SM	1310 nm	9/125 µm	10-29 dB	25-65 km	0.4 dB/km; 3.5 ps/(nm*km)
-LH/LC	SM	1550 nm	9/125 µm	10-29 dB	40-104 km	0.25 dB/km; 19 ps/(nm*km)

Table 4: Fiber port 100BASE-FX (SFP fiber optic Fast ETHERNET Transceiver)

Product code M-SFP-...		Wave length	Fiber	System attenuation	Expansion	Fiber data
-SX/LC...	MM	850 nm	50/125 µm	0-7.5 dB	0-550 m	3.0 dB/km, 400 MHz*km
-SX/LC...	MM	850 nm	62.5/125 µm	0-7.5 dB	0-275 m	3.2 dB/km, 200 MHz*km
-MX/LC...	MM	1310 nm	50/125 µm	0-8 dB	2 km [a]	1.0 dB/km, 500 MHz*km
-MX/LC	MM	1310 nm	62.5/125 µm	0-8 dB	1 km	1.0 dB/km, 500 MHz*km
-LX/LC...	MM	1310 nm[b]	50/125 µm	0-11 dB	0-550 m	1.0 dB/km, 800 MHz*km
-LX/LC...	MM	1310 nm [b]	62.5/125 µm	0-11 dB	0-550 m	1.0 dB/km, 500 MHz*km
-LX/LC...	SM	1310 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km; 3.5 ps/(nm*km)
-LX+/LC	SM	1310 nm	9/125 µm	5-20 dB	14-42 km	0.4 dB/km; 3.5 ps/(nm*km)
-LH/LC...	LH	1550 nm	9/125 µm	6-22 dB	24-72 km	0.25 dB/km; 19 ps/(nm*km)
-LH+/LC	LH	1550 nm	9/125 µm	15-30 dB	71-108 km	0.25 dB/km; 19 ps/(nm*km)
-LH+/LC	LH	1550 nm	9/125 µm	15-30 dB	71-128 km	0.21 dB/km (typical); 19 ps/(nm*km)

Table 5: Fiber port 1000BASE-FX (SFP fiber optic Gigabit ETHERNET Transceiver)

a. Distances up to 3 km reachable, 1000 MHz*km (1300 nm)
b. With F/O adapter compliant with IEEE 802.3-2002 clause 38 (single-mode fiber offset-launch mode conditioning patch cord)

Product code M-SFP-BIDI...	Wave length TX	Wave length RX	Fiber	System attenuation	Expansion	Fiber data
Type A LX/LC EEC SM	1310 nm	1550 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km, 3.5 ps/(nm*km)
Type B LX/LC EEC SM	1550 nm	1310 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km, 3.5 ps/(nm*km)
Type A LH/LC EEC LH	1490 nm	1590 nm	9/125 µm	5-24 dB	23-80 km	0.25 dB/km, 3.5 ps/(nm*km)
Type B LH/LC EEC LH	1590 nm	1490 nm	9/125 µm	5-24 dB	23-80 km	0.25 dB/km, 3.5 ps/(nm*km)

Table 6: F/O port (bidirectional Gigabit ETHERNET SFP Transceiver)

MM = Multimode, SM = Singlemode, LH = Singlemode Longhaul

Power consumption/power output, temperature range and order numbers

MACH104 device	Maximum power consumption	Maximum power output
MACH104-20TX-F	35 W	119 Btu (IT)/h
MACH104-20TX-FR	35 W	119 Btu (IT)/h
MACH104-20TX-F-4PoE, when 4 x Class0-PD (powered device) connected	110 W	170 Btu (IT)/h

Name	Operating temperature (chassis)	Order number
MACH104 device		
MACH104-20TX-F	0 °C to +50 °C	942 003-001
MACH104-20TX-FR	0 °C to +50 °C	942 003-101
MACH104-20TX-F-4PoE	0 °C to +50 °C	942 003-201
Gigabit ETHERNET SFP Transceiver		
M - SFP - SX / LC	0 °C to +50 °C	943 014-001
M - SFP - MX / LC	0 °C to +50 °C	942 035-001
M - SFP - LX / LC	0 °C to +50 °C	943 015-001
M - SFP - LX+ / LC	0 °C to +50 °C	942 023-001
M - SFP - LH / LC	0 °C to +50 °C	943 042-001
M - SFP - LH+ / LC	0 °C to +50 °C	943 049-001
Fast ETHERNET SFP Transceiver		
M-FAST SFP-MM/LC	0 °C to +50 °C	943 865-001
M-FAST SFP-SM/LC	0 °C to +50 °C	943 866-001
M-FAST SFP-SM+/LC	0 °C to +50 °C	943 867-001
M-FAST SFP-LH/LC	0 °C to +50 °C	943 868-001
Bidirectional Gigabit ETHERNET SFP Transceiver		
M-SFP-BIDI Type A LX/LC EEC	0 °C to +50 °C	943 974-001
M-SFP-BIDI Type B LX/LC EEC	0 °C to +50 °C	943 974-002
M-SFP-BIDI Type A LH/LC EEC	0 °C to +50 °C	943 975-001

Name	Operating temperature (chassis)	Order number
M-SFP-BIDI Type B LH/LC EEC	0 °C to +50 °C	943 975-002
M-SFP-BIDI Bundle LX/LC EEC (Type A + B)	0 °C to +50 °C	943 974-101
M-SFP-BIDI Bundle LH/LC EEC (Type A + B)	0 °C to +50 °C	943 975-101

Interfaces

MACH104-20TX-F MACH104-20TX-FR MACH104-20TX-F-4PoE	- V.24 port: external management - 1 terminal block, 2-pin: each 1 x signal contact, max. 1 A, 24 V - USB: ACA 21-USB - 4 Gigabit ETHERNET combo ports (alternatively 100/1000 Mbit/s optical SFP slot or 1000/100/10 Mbit/s RJ45 socket) - 20 x Gigabit ETHERNET 10/100/1000 Mbit/s twisted pair, RJ45 socket
MACH104-20TX-FR	Additionally: redundant power supply
MACH104-20TX-F-4PoE	Additionally: Ports 1 to 4 with Power over Ethernet (PoE)

Scope of delivery

Device	Scope of delivery
MACH104-20TX-F MACH104-20TX-FR MACH104-20TX-F-4PoE	MACH104 device Terminal block for signal contact Two brackets with fastening screws (pre-mounted) Housing feet, stick-on Non-heating appliance cable, Euro model CD ROM with user manual Installation user manual

Accessories

Note: Please note that products recommended as accessories may have characteristics that do not fully correspond to those of the corresponding product. This may limit their possible usage in the overall system.

Name	Order number
SFP Transceiver	(see on page 34 „Power consumption/power output, temperature range and order numbers“)
Pocket Guide	280 710-851
AutoConfiguration Adapter ACA 21-USB	943 271-001
Terminal cable	943 301-001
2-pin terminal block (50 units)	943 845-010
Bracket for fastening the housing	943 943-001
Long bracket (+ 50 mm) for fastening the housing (additional)	943 943-101
HiVision Network Management software	943 471-100
Industrial HiVision Network Management software, operator edition	943 156-xxx
OPC Server software HiOPC	943 055-001

Underlying norms and standards

Name	
EN 61000-6-2:2005	Generic norm – immunity in industrial environments
EN 55022:2006 + A1:2007	IT equipment – radio interference characteristics
FCC 47 CFR Part 15:2009	Code of Federal Regulations
IEC/EN 60950-1:2006	Safety for the installation of IT equipment
IEEE 802.1 D	Switching, GARP, GMRP, Spanning Tree
IEEE 802.1 D-1998	Media access control (MAC) bridges (includes IEEE 802.1p Priority and Dynamic Multicast Filtering, GARP, GMRP)
IEEE 802.1 Q	Tagging
IEEE 802.1 Q-1998	Virtual Bridged Local Area Networks (VLAN Tagging, GVRP)
IEEE 802.1 w.2001	Rapid Reconfiguration
IEEE 802.3-2002	Ethernet

Table 7: List of norms and standards

The device has a certification based on a specific standard only if the certification indicator appears on the housing.
However, with the exception of Germanischer Lloyd, ship certifications are only included in the product information under www.beldensolutions.com.

A Further Support

Technical Questions and Training Courses

In the event of technical queries, please contact your local Hirschmann distributor or Hirschmann office.
You can find the addresses of our distributors on the Internet: www.beldensolutions.com.

Our support line is also at your disposal:

- Tel. +49 1805 14-1538
- Fax +49 7127 14-1551

Answers to Frequently Asked Questions can be found on the Hirschmann internet site (www.beldensolutions.com) at the end of the product sites in the FAQ category.
The current training courses to technology and products can be found under http://www.hicomcenter.com.

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- Consulting incorporates comprehensive technical advice, from system evaluation through network planning to project planing.
- Training offers you an introduction to the basics, product briefing and user training with certification.
- Support ranges from the first installation through the standby service to maintenance concepts.

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